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DECUS NO.	8-379a
TITLE	DOUBLE PRECISION AND FLOATING POINT INTERCHANGER
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SOURCE LANGUAGE	PAL III

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DOUBLE PRECISION AND FLOATING POINT INTERCHANGER

DECUS Program Library Write-up

DECUS No. 8-379a

ABSTRACT

This is a subroutine for conversion of double precision to floating point format and vice versa. A routine to move the radix point in a double precision number to any location is also included as a separate subroutine.

1000

1000

1000

1000

EXTENDED ROTATE CHECKER

START AT(REV DP NOTATION): 0010\0000\0300

ROTATE NUM TO RADIX PLACE: 3

MAKE INCREMENTS OF(REV DP NOTATION): 0010\0000\0010

NUMBER BEFORE ROTATION	NUMBER AFTER ROTATION
0010\0000\0300	0003\3000\0000
0010\0000\0310	0003\3100\0000
0010\0000\0320	0003\3200\0000
0010\0000\0330	0003\3300\0000
0010\0000\0340	0003\3400\0000
0010\0000\0350	0003\3500\0000
0010\0000\0360	0003\3600\0000
0010\0000\0370	0003\3700\0000
0010\0000\0400	

HAVE REACHED POINT OF ERROR:

LAST TYPED NUMBER CANNOT BE ROTATED LEFT THE PRESCRIBED AMOUNT.

EXTENDED ROTATE CHECKER

START AT(REV DP NOTATION): 0010\0000\0500

ROTATE NUM TO RADIX PLACE: 3

MAKE INCREMENTS OF(REV DP NOTATION): 0010\7777\7770

NUMBER BEFORE ROTATION	NUMBER AFTER ROTATION
0010\0000\0500	

HAVE REACHED POINT OF ERROR:

LAST TYPED NUMBER CANNOT BE ROTATED LEFT THE PRESCRIBED AMOUNT.

EXTENDED ROTATE CHECKER

START AT(REV DP NOTATION): 0006\0000\1000

ROTATE NUM TO RADIX PLACE: 2

MAKE INCREMENTS OF(REV DP NOTATION): 0006\7777\7700

NUMBER BEFORE ROTATION	NUMBER AFTER ROTATION
0006\0000\1000	0002\1000\0000
0006\0000\0700	0002\0700\0000
0006\0000\0600	0002\0600\0000
0006\0000\0500	0002\0500\0000
0006\0000\0400	0002\0400\0000
0006\0000\0300	0002\0300\0000
0006\0000\0200	0002\0200\0000
0006\0000\0100	0002\0100\0000
0006\0000\0000	0002\0000\0000
0006\7777\7700	0002\7700\0000
0006\7777\7600	0002\7600\0000
0006\7777\7500	0002\7500\0000
0006\7777\7400	0002\7400\0000
0006\7777\7300	0002\7300\0000
0006\7777\7200	0002\7200\0000
0006\7777\7100	0002\7100\0000
0006\7777\7000	0002\7000\0000

EXTENDED ROTATE CHECKER

START AT(REV DP NOTATION): 0006\7777\7000

ROTATE NUM TO RADIX PLACE: 2

MAKE INCREMENTS OF(REV DP NOTATION): 0006\0000\0100

NUMBER BEFORE ROTATION	NUMBER AFTER ROTATION
0006\7777\7000	0002\7000\0000
0006\7777\7100	0002\7100\0000
0006\7777\7200	0002\7200\0000
0006\7777\7300	0002\7300\0000
0006\7777\7400	0002\7400\0000
0006\7777\7500	0002\7500\0000
0006\7777\7600	0002\7600\0000
0006\7777\7700	0002\7700\0000
0006\0000\0000	0002\0000\0000
0006\0000\0100	0002\0100\0000
0006\0000\0200	0002\0200\0000
0006\0000\0300	0002\0300\0000
0006\0000\0400	0002\0400\0000
0006\0000\0500	0002\0500\0000
0006\0000\0600	0002\0600\0000

EXTENDED ROTATE CHECKER

START AT(REV DP NOTATION): 0004\7775\0000

ROTATE NUM TO RADIX PLACE: 1

MAKE INCREMENTS OF(REV DP NOTATION): 0004\7777\7000

NUMBER BEFORE ROTATION	NUMBER AFTER ROTATION
0004\7775\0000	0001\5000\0000
0004\7774\7000	0001\4700\0000
0004\7774\6000	0001\4600\0000
0004\7774\5000	0001\4500\0000
0004\7774\4000	0001\4400\0000
0004\7774\3000	0001\4300\0000
0004\7774\2000	0001\4200\0000
0004\7774\1000	0001\4100\0000
0004\7774\0000	0001\4000\0000
0004\7773\7000	

HAVE REACHED POINT OF ERROR:

LAST TYPED NUMBER CANNOT BE ROTATED LEFT THE PRESCRIBED AMOUNT.

EXTENDED ROTATE CHECKER

START AT(REV DP NOTATION): 0004\7773\0000

ROTATE NUM TO RADIX PLACE: 1

MAKE INCREMENTS OF(REV DP NOTATION): 0004\0000\1000

NUMBER BEFORE ROTATION	NUMBER AFTER ROTATION
0004\7773\0000	

HAVE REACHED POINT OF ERROR:

LAST TYPED NUMBER CANNOT BE ROTATED LEFT THE PRESCRIBED AMOUNT.

0000			*20	
0001			Pmode	
0002			//DOUBLE PRECISION AND FLOATING POINT NUMBER---	
0003			//	INTERCHANGER WITH ROTATE
0004			//	ROTATE:
0005			//	ENTRY INTO SUBROUTINE: JMS I L175
0006			//	PREPARATION: PUT DP NUMBER IN LOCS---
0007			//	170-72(EXP) IN REVERSE---
0010			//	DP NOTATION AS NOTED BELOW---
0011			//	AND TAD THE NEW RADIX PLACE---
0012			//	JUST BEFORE THE JMS.
0013			//	DP NUMBER IS CHANGED TO THE NEW CONFIGURATION ---
0014			//	GIVEN BY THE NUMBER IN THE AC JUST---
0015			//	BEFORE THE JMS.
0016			//	FPTODE:
0017			//	ENTRY INTO SUBROUTINE: JMS I L173
0020			//	PREPARATION: PUT FP NUMBER IN LOCS---
0021			//	170-72(EXP)
0022			//	FP NUMBER IS CHANGED TO REVERSE DP---
0023			//	NOTATION AS NOTED BELOW, RESULT ---
0024			//	IS PLACED IN LOCS 170-72(EXP)
0025			//	DPTOPF:
0026			//	ENTRY INTO SUBROUTINE: JMS I L174
0027			//	PREPARATION: PLACE DOUBLE PRECISION---
0030			//	NUMBER IN LOCS 170-72 AS ---
0031			//	NOTED BELOW IN REFERSE DP---
0032			//	NOTATION
0033			//	DP NUMBER IS CHANGED TO NORMAL FP NUMBER---
0034			//	AND PLACED IN LOCS 170-72(EXP)
0035			//	REVERSE DP NOTATION:
0036			//	OCTAL MSH LSH
0037			//	0 0 0 0/ 0 0 0 0/ 0 0 0 0
0040			//	RADIX ↑ ↑ ↑ ↑ ↑ ↑ ↑ ↑
0041			//	PLACE 0 1 2 3 4 5 6 7 10
0042				*170
0043	0170	0000	EXP,	0;
0043	0171	0000	0;	
0043	0172	0000	0	
0044	0173	5320	L173,	5320
0045	0174	5325	L174,	5325
0046	0175	5200	L175,	5200
0047			*5200	
0050	5200	0000	ROTATE,	0
0051	5201	3316		DCA EXPHLD
0052	5202	4365		JMS MTEST
0053	5203	1316		TAD EXPHLD
0054	5204	7041		CIA
0055	5205	1170		TAD EXP
0056	5206	7450		SNA
0057	5207	5600		JMP I ROTATE

0060	5210	3170	
0061	5211	1170	
0062	5212	1170	
0063	5213	1170	
0064	5214	3170	
0065	5215	1170	
0066	5216	7700	
0067	5217	5255	
0070	5220	5223	
0071	5221	4711	
0072	5222	4300	
0073	5223	1170	ROTR,
0074	5224	1373	
0075	5225	7640	
0076	5226	5221	
0077	5227	1172	
0100	5230	0374	
0101	5231	7450	
0102	5232	5241	
0103	5233	7104	
0104	5234	1172	
0105	5235	3172	
0106	5236	7004	
0107	5237	1171	
0110	5240	3171	
0111	5241	4711	
0112	5242	4300	
0113	5243	1170	
0114	5244	7640	
0115	5245	5241	
0116	5246	5275	
0117	5247	4710	
0120	5250	1170	
0121	5251	7650	
0122	5252	5275	
0123	5253	2320	
0124	5254	5247	
0125	5255	1375	ROTL,
0126	5256	3320	
0127	5257	1171	
0130	5260	7110	
0131	5261	1313	
0132	5262	7510	
0133	5263	5247	
0134	5264	1314	
0135	5265	7700	
0136	5266	5247	
0137	5267	7300	ERROR,
0140	5270	1317	
0141	5271	6046	
0142	5272	6041	

DCA EXP
 TAD EXP
 TAD EXP
 TAD EXP
 DCA EXP
 TAD EXP
 SMA CLA
 JMP ROTL
 JMP ROTR
 JMS I RTARPT
 JMS MSETUP
 TAD EXP
 TAD PP3
 SZA CLA
 JMP ROTR-2
 TAD EXP+2
 AND P4
 SNA
 JMP .+7
 CLL RAL
 TAD EXP+2
 DCA EXP+2
 RAL
 TAD EXP+1
 DCA EXP+1
 JMS I RTARPT
 JMS MSETUP
 TAD EXP
 SZA CLA
 JMP .-4
 JMP OUT
 JMS I RTALPT
 TAD EXP
 SNA CLA
 JMP OUT
 ISZ COUNT1
 JMP .-5
 TAD MM3
 DCA COUNT1
 TAD EXP+1
 CLL RAR
 TAD TEST1
 SPA
 JMP ROTL-6
 TAD TEST2
 SMA CLA
 JMP ROTL-6
 CLA CLL
 TAD BELL
 TLS
 TSF

Ø143	5273	5272		JMP .-1
Ø144	5274	5271		JMP .-3
Ø145	5275	1316	OUT,	TAD EXPHLD
Ø146	5276	317Ø		DCA EXP
Ø147	5277	56ØØ		JMP I ROTATE
Ø15Ø	53ØØ	ØØØØ	MSETUP,	Ø
Ø151	53Ø1	1315		TAD MFLAG
Ø152	53Ø2	765Ø		SNA CLA
Ø153	53Ø3	57ØØ		JMP I MSETUP
Ø154	53Ø4	1171		TAD EXP+1
Ø155	53Ø5	1312		TAD K4ØØØ
Ø156	53Ø6	3171		DCA EXP+1
Ø157	53Ø7	57ØØ		JMP I MSETUP
Ø16Ø	531Ø	5546	RTALPT,	ROTAL
Ø161	5311	5531	RTARPT,	ROTAR
Ø162	5312	4ØØØ	K4ØØØ,	4ØØØ
Ø163	5313	76ØØ	TEST1,	-2ØØ
Ø164	5314	44ØØ	TEST2,	-34ØØ
Ø165	5315	ØØØØ	MFLAG,	Ø
Ø166	5316	ØØØØ	FPORDP,	Ø
Ø167	5317	Ø2Ø7	BELL,	2Ø7
Ø17Ø			*532Ø	
Ø171	532Ø	ØØØØ	FPDP,	Ø
Ø172	5321	73ØØ		CLA CLL
Ø173	5322	3316		DCA FPORDP
Ø174	5323	2316		ISZ FPORDP
Ø175	5324	533Ø		JMP .+4
Ø176	5325	ØØØØ	DPFP,	Ø
Ø177	5326	73ØØ		CLA CLL
Ø2ØØ	5327	3316		DCA FPORDP
Ø2Ø1	533Ø	4365		JMS MTEST
Ø2Ø2	5331	4346		JMS FMINUS
Ø2Ø3	5332	1316		TAD FPORDP
Ø2Ø4	5333	765Ø		SNA CLA
Ø2Ø5	5334	5776		JMP I DFPT
Ø2Ø6	5335	5777		JMP I FDPT
Ø2Ø7	5336	1315	IN,	TAD MFLAG
Ø21Ø	5337	764Ø		SZA CLA
Ø211	534Ø	4346		JMS FMINUS
Ø212	5341	3315		DCA MFLAG
Ø213	5342	1316		TAD FPORDP
Ø214	5343	765Ø		SNA CLA
Ø215	5344	5725		JMP I DPFP
Ø216	5345	572Ø		JMP I FPDP
Ø217	5346	ØØØØ	FMINUS,	Ø
Ø22Ø	5347	1315		TAD MFLAG
Ø221	535Ø	765Ø		SNA CLA
Ø222	5351	5746		JMP I FMINUS
Ø223	5352	73ØØ		CLA CLL
Ø224	5353	1171		TAD EXP+1

0225	5354	7040		CMA	
0226	5355	3171		DCA EXP+1	
0227	5356	1172		TAD EXP+2	
0230	5357	7041		CIA	
0231	5360	3172		DCA EXP+2	
0232	5361	7204		GLK	
0233	5362	1171		TAD EXP+1	
0234	5363	3171		DCA EXP+1	
0235	5364	5746		JMP I FMINUS	
0236	5365	0000	MTEST,	0	
0237	5366	1171		TAD EXP+1	
0240	5367	7710		SPA CLA	
0241	5370	7001		IAC	
0242	5371	3315		DCA MFLAG	
0243	5372	5765		JMP I MTEST	
0244	5373	0003	PP3,	3	
0245	5374	0004	P4,	4	
0246	5375	7775	MM3,	-3	
0247	5376	5476	DFPT,	DPTOPF	
0250	5377	5400	FDPT,	FPTODP	
0251			*5400		
0252	5400	7300	FPTODP,	CLA CLL	
0253	5401	1170		TAD EXP	//SET COUNT=EXP
0254	5402	3375		DCA COUNT	//FOR PRELIMINARIES
0255	5403	1375		TAD COUNT	
0256	5404	1366		TAD P23	
0257	5405	7710		SPA CLA	//FP NUM TOO SMALL?
0260	5406	5764		JMP I ERRPT	
0261	5407	1375		TAD COUNT	//NO: GO ON
0262	5410	1372		TAD M24	
0263	5411	7700		SMA CLA	//FP NUM TOO BIG?
0264	5412	5764		JMP I ERRPT	
0265	5413	1375	GO,	TAD COUNT	//NO: GO ON
0266	5414	7540		SMA SZA	//COUNT>ZERO?
0267	5415	5222		JMP CHECK1	//YES: CHECK IF EXP=1,2,3
0270	5416	1365		TAD P3	//NO: ADD +3 TILL
0271	5417	5214		JMP .-3	//COUNT>ZERO
0272	5420	3375		DCA COUNT	
0273	5421	1375		TAD COUNT	
0274	5422	1367	CHECK1,	TAD M1	
0275	5423	7440		SZA	//COUNT=1?
0276	5424	5227		JMP CHECK2	//NO
0277	5425	4331		JMS ROTAR	//YES: ROTATE FP NUM
0300	5426	5236		JMP FIG1	//ONE PLACE RIGHT
0301	5427	1367	CHECK2,	TAD M1	
0302	5430	7450		SNA	//COUNT=2?
0303	5431	5236		JMP FIG1	//YES: ALL IS COOL
0304	5432	1367	CHECK3,	TAD M1	//NO
0305	5433	7440		SZA	//COUNT=3?

0306	5434	5220		JMP CHECK1-2	//NO: GO CHECK AGAIN
0307	5435	4346		JMS ROTAL	//YES: ROTATE FP NUM
0310					//ONE PLACE LEFT
0311	5436	1170	FIG1,	TAD EXP	
0312	5437	7001		IAC	
0313	5440	7710		SPA CLA	
0314	5441	5252		JMP FIG1A	
0315	5442	1170		TAD EXP	
0316	5443	1371		TAD M23	
0317	5444	7700		SMA CLA	//END OF FP NUM YET?
0320	5445	5263		JMP FIG2	//YES
0321	5446	1172		TAD EXP+2	//NO
0322	5447	0373		AND MASK1	
0323	5450	7640		SZA CLA	//LAST PLACE OF LSH FILLED YET?
0324	5451	5260		JMP FIG1B	
0325	5452	1370	FIG1A,	TAD M3	//ROTATE RIGHT 3 TIMES
0326	5453	3375		DCA COUNT	
0327	5454	4331		JMS ROTAR	
0330	5455	2375		ISZ COUNT	
0331	5456	5254		JMP .-2	
0332	5457	5236		JMP FIG1	
0333	5460	1171	FIG1B,	TAD EXP+1	
0334	5461	7710		SPA CLA	
0335	5462	5252		JMP FIG1A	
0336	5463	3375	FIG2,	DCA COUNT	
0337	5464	1170		TAD EXP	
0340	5465	7001		IAC	
0341	5466	7450		SNA	//DIVISION DONE YET
0342	5467	5273		JMP FIG3	//YES
0343	5470	1370		TAD M3	//NO
0344	5471	2375		ISZ COUNT	
0345	5472	5266		JMP .-4	
0346	5473	1375	FIG3,	TAD COUNT	//COUNT=RADIX PLACE OF
0347	5474	3170		DCA EXP	//DP NUM
0350	5475	5763		JMP I INPT	
0351	5476	7300	DPTOFP,	CLA CLL	
0352	5477	1170		TAD EXP	
0353	5500	1170		TAD EXP	
0354	5501	1170		TAD EXP	
0355	5502	1367		TAD M1	
0356	5503	3376		DCA RDIXMV	//RDIXMV=(3 X EXP) + 1
0357	5504	3170		DCA EXP	
0360	5505	1171		TAD EXP+1	
0361	5506	7700		SMA CLA	//DP NUM ONE PLACE TOO LEFT?
0362	5507	5312		JMP CONVRT	//NO
0363	5510	4331		JMS ROTAR	//YES: ROTATE ONE PLACE RIGHT
0364	5511	5325		JMP EXPCLC	
0365	5512	1171	CONVRT,	TAD EXP+1	

0366	5513	0374	AND MASK2	
0367	5514	7640	SZA CLA	//DP NUM RIGHT YET?
0370	5515	5325	JMP EXPCLC	//YES
0371	5516	4346	JMS ROTAL	//NO
0372	5517	1170	TAD EXP	
0373	5520	1366	TAD P23	
0374	5521	7640	SZA CLA	//DONE THE WHOLE NUM YET?
0375	5522	5312	JMP CONVRT	//NO
0376	5523	3170	DCA EXP	//YES: GO AWAY
0377	5524	5763	JMP I INPT	
0400	5525	1170	EXPCLC, TAD EXP	
0401	5526	1376	TAD RDIXMV	
0402	5527	3170	DCA EXP	//VALUE OF FP EXPONENT
0403	5530	5763	JMP I INPT	
0404	5531	0000	ROTAR, 0	//ROTATES BOTH HALVES OF
0405	5532	7300	CLA CLL	//NUM (MSH AND LSH) RIGHT
0406	5533	1170	TAD EXP	//ONE PLACE. ADDS +1 TO
0407	5534	7001	IAC	//EXP
0410	5535	3170	DCA EXP	
0411	5536	1171	TAD EXP+1	
0412	5537	7110	CLL RAR	
0413	5540	3171	DCA EXP+1	
0414	5541	1172	TAD EXP+2	
0415	5542	7010	RAR	
0416	5543	3172	DCA EXP+2	
0417	5544	7300	CLA CLL	
0420	5545	5731	JMP I ROTAR	
0421	5546	0000	ROTAL, 0	//ROTATES BOTH HALVES OF
0422	5547	7300	CLA CLL	//NUM (MSH AND LSH) LEFT
0423	5550	1170	TAD EXP	//ONE PLACE. ADDS -1 TO
0424	5551	1367	TAD M1	//EXP
0425	5552	3170	DCA EXP	
0426	5553	1172	TAD EXP+2	
0427	5554	7104	CLL RAL	
0430	5555	3172	DCA EXP+2	
0431	5556	1171	TAD EXP+1	
0432	5557	7004	RAL	
0433	5560	3171	DCA EXP+1	
0434	5561	7300	CLA CLL	
0435	5562	5746	JMP I ROTAL	
0436	5563	5336	INPT, IN	
0437	5564	5267	ERRPT, ERROR	
0440	5565	0003	P3, 3	
0441	5566	0027	P23, 27	
0442	5567	7777	M1, -1	
0443	5570	7775	M3, -3	
0444	5571	7751	M23, -27	
0445	5572	7750	M24, -30	

0446	5573	0007	MASK1,	0007
0447	5574	2000	MASK2,	2000
0450	5575	0000	COUNT,	0
0451	5576	0000	RDIXMV,	0
0452				EXPHLD=FPORDP
0453				COUNT1=FPDP

NO ERRORS

BELL	5317
CHECK1	5422
CHECK2	5427
CHECK3	5432
CONVRT	5512
COUNT	5575
COUNT1	5320
DFPT	5376
DPFP	5325
DPTOPF	5476
ERROR	5267
ERRPT	5564
EXP	0170
EXPCLC	5525
EXPHLD	5316
FDPT	5377
FIG1	5436
FIG1A	5452
FIG1B	5460
FIG2	5463
FIG3	5473
FMINUS	5346
FPDP	5320
FPORDP	5316
FPTODP	5400
GO	5413
IN	5336
INPT	5563
K4000	5312
L173	0173
L174	0174
L175	0175
MASK1	5573
MASK2	5574
MFLAG	5315
MM3	5375
MSETUP	5300
MTEST	5365
M1	5567

M23	5571
M24	5572
M3	5570
OUT	5275
PP3	5373
P23	5566
P3	5565
P4	5374
RDIXMV	5576
ROTAL	5546
ROTAR	5531
ROTATE	5200
ROTL	5255
ROTR	5223
RTALPT	5310
RTARPT	5311
TEST1	5313
TEST2	5314

